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August 27, 2013

L-13-261

10 CFR 50.73

ATTN: Document Control Desk
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject:
Davis-Besse Nuclear Power Station, Unit 1
Docket Number 50-346, License Number NPF-3
Licensee Event Report 2013-001

Enclosed is Licensee Event Report (LER) 2013-001-00, "Reactor Trip Due to Reactor Coolant Pump 1-2 Motor Faulty Electrical Connection." This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this letter or its enclosure. The actions described represent intended or planned actions and are described for information only. If there are any questions or if additional information is required, please contact Mr. Patrick J. McCloskey, Manager – Site Regulatory Compliance, at (419) 321-7274.

Sincerely,

Raymond A. Lieb

VAW

Enclosure: LER 2013-001

cc: NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager
Utility Radiological Safety Board

IE22
NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. PAGE |
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**4. TITLE**

Reactor Trip Due to Reactor Coolant Pump Motor Faulty Electrical Connection

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| 06 | 29 | 2013 | 2013 | - 001 | - 00 | 08 | 27 | 2013 | | 05000 |
| | | | | | | | | | FACILITY NAME | DOCKET NUMBER 05000 |

**9. OPERATING MODE**

1

**10. POWER LEVEL**

100

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:** (Check all that apply)

| | | | |
|---|---|---|---|
| ☐ 20.2201(b) | ☐ 20.2203(a)(3)(i) | ☐ 50.73(a)(2)(i)(C) | ☐ 50.73(a)(2)(vii) |
| ☐ 20.2201(d) | ☐ 20.2203(a)(3)(ii) | ☐ 50.73(a)(2)(ii)(A) | ☐ 50.73(a)(2)(viii)(A) |
| ☐ 20.2203(a)(1) | ☐ 20.2203(a)(4) | ☐ 50.73(a)(2)(ii)(B) | ☐ 50.73(a)(2)(viii)(B) |
| ☐ 20.2203(a)(2)(i) | ☐ 50.36(c)(1)(i)(A) | ☐ 50.73(a)(2)(iii) | ☐ 50.73(a)(2)(ix)(A) |
| ☐ 20.2203(a)(2)(ii) | ☐ 50.36(c)(1)(ii)(A) | ☒ 50.73(a)(2)(iv)(A) | ☐ 50.73(a)(2)(x) |
| ☐ 20.2203(a)(2)(iii) | ☐ 50.36(c)(2) | ☐ 50.73(a)(2)(v)(A) | ☐ 73.71(a)(4) |
| ☐ 20.2203(a)(2)(iv) | ☐ 50.46(a)(3)(ii) | ☐ 50.73(a)(2)(v)(B) | ☐ 73.71(a)(5) |
| ☐ 20.2203(a)(2)(v) | ☐ 50.73(a)(2)(i)(A) | ☐ 50.73(a)(2)(v)(C) | ☐ OTHER |
| ☐ 20.2203(a)(2)(vi) | ☐ 50.73(a)(2)(i)(B) | ☐ 50.73(a)(2)(v)(D) | Specify in Abstract below or in NRC Form 366A |

**12. LICENSEE CONTACT FOR THIS LER**

| FACILITY NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Vicki A. Wadsworth, Senior Engineering Specialist, Regulatory Compliance | (419) 321-7690 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| B | AB | MBX | M080 | N | B | AB | XCT | W120 | N |

**14. SUPPLEMENTAL REPORT EXPECTED**

☐ YES (If yes, complete EXPECTED SUBMISSION DATE). ☒ NO

**15. EXPECTED SUBMISSION DATE**

| MONTH | DAY | YEAR |
|---|---|---|
| | | |

**ABSTRACT** *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*


On June 29, 2013, at 2120 hours, with the Davis-Besse Nuclear Power Station operating at approximately 100 percent power, the Reactor Coolant Pump (RCP) Motor 1-2 tripped due to actuation of a differential trip relay in the motor source breaker. This resulted in a reactor trip at 2122 hours from the Reactor Protection System on Flux/Delta-Flux/Flow. Investigation determined the cause of the RCP motor trip to be a failure in the current transformer (CT) circuit. A screw on the RCP Motor 1-2 CT terminal block had a stress/fatigue related failure which caused the wire to detach in the CT circuitry causing an open circuit and actuation of the differential trip. The investigation also found degraded wiring in the CT circuit because it was touching the high voltage buss bar insulation in the RCP motor termination box and experienced degradation caused by corona discharge. The CT wiring and terminal block including all screws were replaced. The screws were replaced with a different type of material. Procurement documents will be revised to ensure replacement hardware is of appropriate quality to meet ANSI standards. The CT wiring, terminal blocks and screws in all four RCPs will be inspected during the next scheduled outage.

This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in automatic actuation of the Reactor Protection System.

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NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

DESCRIPTION OF EVENT:

System Description

The Davis-Besse Nuclear Power Station (DBNPS) Reactor Coolant System (RCS) [AB] uses four Reactor Coolant Pumps (RCPs) [AB-P] to circulate the reactor coolant. Each RCP is a single-stage centrifugal pump designed to produce a flow of approximately 90,000 gallons per minute (gpm) and driven at approximately 1200 revolutions per minute (rpm) by a 13,200 volt motor [AB-MO]. The RCP motors are designed to provide sufficient torque to start the RCP with reverse RCS flow conditions and applied voltage of 75% rated voltage for RCP coastdown flow for a loss of offsite power and thrust bearing for the RCP. Each RCP motor has a two-piece bolted flywheel to increase the rotational inertia, thus prolonging RCP coastdown time and assuring a more gradual loss of main coolant flow in the event of a RCP trip. The RCP motor controls are designed to provide only essential motor trips because maintained RCP operation is desirable even when the reactor trips. One of these controls consists of a phase current differential relay which will trip the motor when the phases are not balanced.

Event Description:

On June 29, 2013, at 2120 hours with the DBNPS operating in Mode 1 at approximately 100 percent power at normal operating temperature and pressure (RCS pressure approximately 2150 pounds per square inch (psi) and temperature approximately 582 degrees Fahrenheit), a wire detached in the RCP Motor 1-2 current transformer (CT) circuitry, causing an open circuit in one of the CTs. The resultant difference in the indicated motor phase current resulted in actuation of the differential trip relay in the motor source breaker HB03, opening the breaker to trip the RCP Motor 1-2. The trip of RCP Motor 1-2 reduced RCS flow, actuating a trip of the Reactor Protection System on Flux/Delta-Flux/Flow, resulting in a trip of the reactor at 2122 hours.

Unit response to the reactor trip was as designed and not complicated. Plant parameters stabilized within their normal post-trip values. A Steam Generator startup feedwater valve went full closed following Rapid Feedwater Reduction. The expected response was to control Steam Generator level to 40 inches based on level error. Operators placed the valve in manual to control level. Three Main Steam Safety Valves (MSSV) [SB-RV] were observed to not fully reseat. Operators lowered Steam Generator pressure to approximately 930 psig in order to allow the valves to reseat.

A field inspection of the RCP Motor 1-2 termination box, which is attached to the RCP motor, discovered degradation of the current transformer (CT) wiring and associated terminal block. Additional testing performed on the RCP motor and CT wiring did not identiy any issues other than the degraded wiring and terminal block. The degradation observed in the RCP Motor 1-2 termination box on the CT wiring was consistent with damage caused by corona and/or partial discharge degradation. The terminal block screws all showed signs of degradation. Two screw heads were found broken. One screw and wiring had lifted from the terminal block causing the CT circuit to open. The other screw wire lug maintained connection. The degraded wiring and terminal block from RCP 1-2 were replaced as well as all screws in the terminal block were replaced with quality screws in accordance with the American National Standards Institute (ANSI).

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The plant returned to 100% power on July 14, 2013 at 0300 hours.

CAUSE OF EVENT:

The RCP motor trip was caused by a failure of terminal block screws and CT wiring degradation. The CT wiring was found with two areas of damage caused by corona discharge from the 13.8 KV buss bar. The damage occurred where the CT wiring was touching the high voltage buss bar insulation in the RCP Motor 1-2 termination box. The wiring and the terminal block and screws had been installed approximately three years prior to the event in 2010. The wiring appears to have been installed in the same manner as the original CT wiring. However, the replacement wiring was more flexible than the original wiring which may have allowed the wiring to move during RCP operation due to vibration or due to changing magnetic fields when starting the RCP. The degradation occurred after the wire moved such that it touched the buss bar insulation.

The 2010 replacement terminal block screws degraded and failed due to stress and cycle fatigue. The terminal block is located in a hot, moist environment and is subject to vibration from the RCP motor. The originally installed screws, replaced in 2010, had lasted over 30 years and not failed. The replacement screws were likely substandard and would not have met the requirements of the originally installed equipment. The replacement terminal block and screws were purchased commercial grade. The material was not checked to ensure the terminal block screws would meet the applicable standards for quality or the application where the screws were used.

ANALYSIS OF EVENT:

There were no safety concerns identified during or as a result of this event. When the Control Rod Drive Trip Breakers opened, all Control Rods inserted. The Steam Generator outlet pressure increased due to the closing of the Main Turbine Stop Valves [TA-ISV]. The Turbine Bypass Valves [SB-PCV] and the Atmospheric Vent Valves (AVVs) [SB-PCV] opened and the MSSVs lifted in response to the increasing secondary system pressure. The MSSVs (except for the three MSSVs described above) and the AVVs closed as Steam Generator outlet pressure decreased. The Safety Features Actuation System [JE] was not challenged during this event, and there were no significant deviations in Reactor Coolant System pressure, temperature, inventory control or in Steam Generator pressure or inventory control.

Reportability Discussion:

The Reactor Protection System actuation resulted in the automatic reactor trip. Because this Reactor Protection System actuation was not part of a pre-planned sequence during testing or reactor operation, this event is reportable within four hours of occurrence per 10 CFR 50.72(b)(2)(iv)(B) ). On June 29, 2013, at 2248 hours, the NRC Operations Center was notified of the automatic trip of Reactor Coolant Pump Motor 1-2 due to an electrical differential current fault that resulted in a Reactor Protection System actuation on Flux/Delta-Flux/Flow. (Event Number 49159).

This issue is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), which requires reporting of any event or condition that resulted in manual or automatic actuation of the Reactor Protection System, including a reactor scram or reactor trip.

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NARRATIVE

CORRECTIVE ACTIONS:

Extent of condition was verified through walkdowns or review of pictures on the other three RCP motor terminal blocks and found no damage or degradation to the CT wiring or terminal block and screws.

On RCP Motor 1-2, the degraded CT wiring, terminal block and screws were replaced. The screws were replaced with silicon bronze screws which meets the ANSI standard. A circuit check was performed with resistance and megger tests following replacement of CT wiring, and a RCP Motor 1-2 current transformer test was completed.

The applicable procurement packages will be changed to include verification of vendor supplied terminal fasteners to ensure they meet applicable ANSI standards or to require replacement of vendor supplied fasteners with fasteners that have been verified to meet appropriate standards.

A review of procurement packages for components that have terminal fasteners will be performed to include verification of the quality of vendor supplied terminal fasteners. The procurement packages identified will be documented and changed to incorporate new requirements for terminal fasteners.

The CT wiring, terminal blocks and all terminal block screws in all four RCPs will be inspected during the next refueling outage, scheduled for 2014, to verify that there is no evidence of corona damage and no excessive corrosion or degradation of the terminal block screws.

PREVIOUS SIMILAR EVENTS:

There have been no Licensee Event Reports (LERs) at the DBNPS involving a manual or automatic reactor trip due to RCP motor trip in the past three years.